SECTION 1301

TRENCH EXCAVATION, BEDDING AND BACKFILL

1301-1 GENERAL

1301-1.1 Description. - This work shall consist of the excavating and backfilling of trenches, including the restoration of surfaces, for the installation or repair of storm and sanitary sewers, and other such drainage facilities and their appurtenant structures as shown on the plans, as specified in specifications and the special provisions, and as directed by the Engineer.

1301-1.2 Utilities Excavation Permit. - Before any excavation within an existing City street will be allowed, a Utility Excavation Permit or written approval by the Director shall be obtained and a copy of said permit or approval shall be available at the site of the work. Signed and executed contracts for public improvements or sewer lateral permits issued by the City shall constitute compliance with this Section. The Utilities Excavation Permit shall be maintained on the job at all times.

1301-1.3 Permit to Perform Excavation or Trench Work. - Attention is directed to Section 5-1.02A "Trench Excavation Safety Plans," of the General Conditions. Inasmuch as the City of San Jose does not issue "Permit to Perform Excavation or Trench Work," the Contractor shall secure such a permit from the State of California, Division of Industrial Safety, as required by Section 6500 of the State of California Labor Code.

The permit together with a copy of approved plan for trench excavation safety plan shall be maintained on the job site at all times.

1301-1.4 Survey Monuments and Points. - Whenever monuments, property corners, or other survey points are so located that they may be damaged or destroyed by the proposed excavation, the Contractor shall notify the Engineer, 48 hours prior to start of construction, so that such monuments, property corners, or survey points may be tied out.

1301-1.5 Existing Utilities. - In accordance with the provisions of Section 7-1.11 "Preservation of Property" and in Section 8-1.10 "Utility and Non-Highway Facilities" of the General Conditions, existing facilities shall be protected from damage. Any damage done to utility facilities shall be reported to the respective utility owner by the Contractor, and any repair work required shall be done by such company's repair crew. Prior to backfilling, all repair work shall be approved by the Engineer.

All sewer and utility lines that cross or lie along the trench shall be adequately supported during construction and such supports left in place. Care should be exercised when backfilling around such lines to avoid any damage to them. Any pipeline or lateral, storm or sanitary, cut or damaged in any way shall be replaced in kind. The damaged pipe shall be replaced between adjacent joints. No patching of damaged pipe will be permitted. When it is impossible to avoid damaging signal facilities installed in the pavement, coordination with the City Streets and Traffic Department is required. Damage to traffic signal loops, pads,

interconnect cables, conduits or fire alarm conduits shall be repaired or replaced as directed by the Engineer.

All traffic markers and markings damaged or destroyed shall be replaced unless otherwise directed by the Engineer.

1301-1.6 Backfill and Surface Restoration Methods. - Backfill and restoration of surface for trenches are classified by method in accordance with the type of backfill and surfacing materials required, depending on the location of the trench. The methods are as specified in Section 1301-4.2 "Backfill and Surface Restoration," and as shown below:

Table 1301-1
Backfill & Surface Restoration Methods

Method	Backfill	Restoration of Surface Material	Location
A	Structural Backfill	1" Surface over 8" Deeplift AC or as shown on plans	(1) Transverse Crossing All Streets (2) Longitudinal Trench Openings - Select Major Streets (3) Inspection Cuts or Pot Holes
B	Native	12" Agg. Base w/ 3" AC Type 'B' 1" Surface AC	(1) Longitudinal Trench Openings - All Streets except as above
C	Native	In Kind	(1) Outside of AC Traveled Way

1301-1.7 Dewatering. - Trenches shall be dewatered as specified on Section 1302-3 "Trench Dewatering" of these City Standard Specification.

1301-2 MATERIALS

1301-2.1 Bedding. - Bedding material shall conform to the following criteria:

1301-2.1.1 Class I. - Class I Bedding shall have a Durability Index (Calif. Test No. 29) of not less than 30. Where percent passing the #1 sieve is equal or greater than 8%, the Sand equivalent (Calif. Test No. 217) shall not be less than 40. Gradation requirements are shown in Table I.

1301-2.1.2 Class II. - Class II Bedding shall have a Durability Index (Calif. Test No. 229) of not less than 40 and a Sand Equivalent (Calif. Test No. 217) of not less than 60. Gradation requirements are shown in Table I.

1301-2.1.3 Class III. - Class III Bedding shall meet the gradation and Sand Equivalent (Calif. Test No. 217) requirements of Structure Backfill described in Section 19-3.06 of the Standard Specifications.

1301-2.1.4 Class IV. - Class IV Bedding shall be native soils and not be bedrock, cobbles, etc. Gradation requirements are shown in Table I.

1301-2.1.5 Class V. - Class V Bedding shall be plain or reinforced Class A Portland cement concrete, constructed as specified in the special provisions and shown on the plans.

Table 1
Bedding Gradation

	Bedding Class (Gradation - Percent Passing)			
Sieve Size	**I**	**II**	**III**	**IV**
1"	100	100	see Sec.	100
3/4"	90-100	90-100	19-3.06	90-100
1/2"	---	---		
3/8"	20-55	40-100		
#4	0-10	25-40		
#8	0-5	18-33		
#30		5-15		
#50		0-7		
#200		0-4		

1301-2.2 Backfill. - Backfill material shall conform to the following:

1301-2.2.1 Native Material. - Native material shall be free of vegetation and debris and shall be free of all rocks larger than 3 inches in maximum dimension.

1301-2.2.2 Structural Backfill. - Structural Backfill shall be a mixture of clay, sands, and gravel; shall have a sand equivalent of not less than 20; and shall conform to the following grading:

Sieve Size	Percent Passing
3 Inch	100
No. 4	35-100
No. 30	20-100

In addition, if the material is to densified by jetting, its grading shall be such that it will permit proper densification and draining of the material.

1301-2.3 Controlled Density Fill. - Controlled density fill shall consist of a mixture of aggregate, portland cement, mineral admixtures, water, and at the option of the Engineer, chemical accelerating admixtures.

1301-2.3.1 Portland Cement. - Portland cement shall be Type II Modified conforming to the provisions in Section 90-2.01, "Portland Cement," of

these City Standard Specifications. Mineral admixtures shall not be substituted for portland cement.

1301-2.3.2 Water. - Water shall conform to the provisions in Caltrans Section 90-2.03, "Water" of these City Standard Specifications. Chemical admixtures for accelerating shall be Type C or Type E conforming to the requirements in ASTM C 494.

1301-2.3.3 Aggregates. - Aggregate shall conform to the quality requirements of Caltrans Section 90-2.02, "Aggregates" of these City Standard Specifications. Aggregate shall be well graded from coarse to fine. Aggregate shall have a Sand Equivalent, as tested by California Test 217, of not less than 40.

Aggregate shall be of such size and gradation that, when mixed with Type II modified portland cement and mineral admixtures, and tested in accordance with ASTM C 39, the compressive strength of a sample will not be less than 100 or greater than 200 pounds per square inch at 28 days.

The Contractor shall notify the Engineer, in writing, of the source and grading of the aggregate to be used in the CDF. If material supplier is not approved by the City for CDF, Contractor shall make such material available to the Engineer for sampling and testing at least 45 days prior to scheduled placing of the fill. Should the Contractor change his source of supply, he shall notify the Engineer in writing of the new source and grading, and make that material available for sampling and testing at least 45 days prior to intended use.

1301-2.3.4 Proportioning, Mixing, and Transporting. - The Portland cement content of the controlled density fill shall be not less than 47 pounds per cubic yard except that, after testing samples of the Contractor's proposed supply, the Engineer may order an increase in cement content, if necessary to meet the compressive strength requirement specified above.

Proportioning for controlled density fill shall conform to the requirements for proportioning concrete mixes in Section 90-5, "Proportioning," of these City Standard Specifications except that dividing of aggregate into sizes will not be required.

Mixing and transporting controlled density fill shall conform to the requirements for mixing and transporting concrete in Section 90-6, "Mixing and Transporting," of these City Standard Specifications. Controlled density fill shall have a slump, as tested by ASTM C 43, of not more than 10 inches.

1301-2.4 Surface Restoration Materials. - Surface restoration materials shall conform to the applicable provisions for bases and surfacing specified elsewhere in these City Standard Specifications.

1301-3 EXCAVATION

1301-3.1 General. - Excavation for installation of underground facilities shall conform to the provisions as specified herein.

When excavation is within existing asphalt concrete or Portland cement concrete pavements, the edges of the trench outline shall be cut, before the trenching operation is begun, to a neat line with a cutting device approved by the Engineer.

The removal of asphalt concrete or Portland cement concrete pavements, curbs, gutters, sidewalks, or driveways shall be in accordance with the applicable provisions of Section 16 "Clearing and Grubbing," of these City Standard Specifications.

Excavations shall be performed in such a manner as to avoid any unnecessary damage to streets, sidewalks, landscaping and other existing improvements or facilities.

All underground facilities, such as sewer laterals, water services, gas services and underground electrical or telephone conduit crossing the trench line shall be located and exposed if necessary ahead of any trenching operations. All underground facilities within the limits of work shall be protected from damage due to construction related activities. Excavations in the street shall be performed in such a manner that not more than one traffic lane is restricted in either direction at any time, unless otherwise provided for in these City Standard Specifications, the special provisions, or the permit.

Excavation shall not commence until immediately before installation of the underground facilities. The material from the excavation shall be placed in a position that will not cause damage to or cause obstruction to vehicular and pedestrian traffic nor interfere with surface drainage. All public utility trenches shall be color coded according to Underground Services Alert (USA).

Rubble from the removal of asphalt or portland cement concrete pavements, curbs, gutters, sidewalks, or driveway shall be immediately removed from the site of the work so as to preclude the possibility of contaminating the backfill material.

Unless otherwise permitted in writing by the Engineer, all surplus excavated material shall be immediately removed and disposed of outside of the project limits.

The Contractor shall not sweep construction and other debris into the storm drainage system and shall prevent such materials from entering the storm drains.

The Contractor is advised that disposal of dirt and other debris into the public storm drain system is prohibited under the San Jose Municipal Code and under California State Fish and Game Code. Any fines and penalties levied against the Contractor for violation of the above and related regulations are the sole responsibility of the Contractor.

1301-3.2 Width and Depth of Trench. - All trenches in existing paved areas shall be excavated vertically and shall be of sufficient width to provide free working space on either side of the applicable installation. For installation of pipe conduits (water, storm, sanitary) the width of the trench, clear of shoring, shall allow a minimum clearance of 4 inches on each side of the pipe or bell, for pipe of 4 inches to 24 inches in diameter, and 6 inches on each side of the pipe or bell, the pipe of 27 inches and greater diameter. The maximum width of the trench on each side of the pipe shall not exceed the above minimum plus 25 percent of the outside diameter of the pipe. The walls of the trench shall rise vertically to a height of at least 12 inches above the pipe.

1301-3.3 Bottom of Trench. - The bottom of the trench, with or without bedding material, shall be graded and prepared to provide a firm unyielding and uniform bearing throughout the entire length of pipe conduit. The trench bottom shall be smooth and free from irregularities greater than 1/2-inch diameter, large dirt clods, and any frozen material. If the native material in the trench bottom is not

conducive to fine grading, or as otherwise specified, bedding material shall be used. Bedding shall conform to the requirements of Section 1301-4.1 "Bedding."

1301-3.4 Bracing and Excavations. - Attention is directed to the provisions in Section 7-1.01E, "Trench Safety" of the General Conditions.

The Contractor shall furnish and install all sheet piling, shoring, bracing, lagging or other precautions against caving in or sloughing in of the sides of the trench.

1301-4 BEDDING AND BACKFILL

1301-4.1 Bedding. - Bedding material of the class and type designated on the plans or in the special provisions shall be placed under and about the pipe to the depths shown on the plans, except that Type D does not require bedding material.

Where it becomes necessary to remove boulders or other interfering objects at subgrade for bedding, any void below such subgrade shall be filed with the class and type of bedding material designated in the contract documents. Where concrete is specified to cover the pipe, the top of the concrete shall be considered as the top of the bedding.

If soft spongy, unstable, or other similar material is encountered upon which the bedding material or pipe is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with bedding material suitably densified. Additional bedding so ordered, over the amount required by the contract documents, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work" of the General Conditions. If the necessity for such additional bedding material has been caused by an act or failure to act on the part of the Contractor, or is required for the control of groundwater, the Contractor shall bear the expense of the additional excavation and bedding.

Bedding material shall first be placed so that the pipe is supported for the full length of the barrel. If the pipe is laid in a rock cut, there shall be at least 4inches of bedding below the pipe, even if Type D bedding has been indicated in the contract documents. Then the remainder of the bedding shall be placed.

1301-4.1.1 Type of Bedding. - Pipe shall be embedded entirely, partially or not at all, in accordance to the following types:

Type A Bedding material shall have a minimum thickness beneath the pipe of 4 inches, or one-eight of the outside diameter of the pipe, whichever is greater, and shall be placed around the pipe and extend up the sides of the trench to a height of 12 inches above the pipe.

Type B Bedding material shall have a minimum thickness beneath the pipe of 4 inches, or one-eight of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the trench to the springline of the pipe (mid or quarter point of pipe).

Type C Bedding material shall have a minimum thickness beneath the pipe of 4 inches, or one-eight of the outside diameter of the pipe, whichever is greater, and shall

extend up the sides of the trench to the pipe haunchline (eighth point of pipe).

Type D No bedding material required. Pipe shall be laid on trench bottom and backfilled.

Table 1301-2
Bedding Type

Category of Pipe	Type of Bedding
ABS Composite Pipe	A
ABS Solid Wall Pipe	A
Ductile Iron Pipe	C
Concrete Pipe Plain and Reinforced	
24" Diameter and Less	B
25" Diameter and Greater	A
Corrugated Aluminum Pipe	A
Corrugated Steel Pipe	A
Poly-Vinyl Chloride Pipe	A
Reinforced Plastic Mortar Pipe	A
Vitrified Clay Pipe	A

1301-4.1.2 Placing Bedding or Initial Backfill. - According to the Class and Type of bedding, the bedding material may be required to be placed and compacted in more than one lift. Class I material requires no compacting. Class II and III material requires hand or mechanical compaction. If no material is required for bedding the pipe, the initial backfill shall be carefully shaded around the pipe and carefully compacted to the haunchline of the pipe. Precautions shall be taken to prevent movement of the pipe during placement of bedding or initial backfill.

1301-4.2 Backfill and Surface Restoration. - Surface restoration of pavements in the traveled way shall be replaced in kind or as designated for Method A or B, whichever is greater. Restoration of surfaces outside of traveled way shall be as designated for Method C or as required by the Engineer.

When deemed necessary, the Engineer will make the final determination of backfill and surface restoration methods and materials to be used.

The type of backfill and surface restoration methods shall be as shown on the plans, or as designated on the permit, or special provisions and shall be in accordance with these specifications.

The material supporting, surrounding and/or extending to one foot above the top of the pipe shall be considered as bedding and shall conform to the provisions of Section 1301-4.1 "Bedding." Material from the bedding to the finished or subgrade shall be considered as backfill and shall conform to the provisions for the appropriate method of backfill as herein provided.

No broken pavement, regardless of size, shall be permitted in any back-fill. Not more than one 30 foot segment of trench shall be left open at the end of the day at each independent operation, unless otherwise permitted by the Engineer. Where Method A backfill is required, none of the trench shall be left open at the end of the day except as specifically authorized by the Engineer.

1301-4.2.1. Method A Backfill and Surface Restoration. - Method A backfill and surface restoration shall be used on all sewer and other utility line trenches which are excavated: (1) across existing streets, (2) in the general longitudinal direction of traffic of major city streets, except that when the trench opening is in the parking lane Method B may be allowed, and (3) all inspection or repair cuts in existing streets.

The trench shall be backfilled with either imported backfill material compacted to at least 95 percent compaction or with Controlled Density Fill. Any compaction method is acceptable except jetting. Jetting will only be allowed if approved by the Engineer. The trench backfill may be capped with 8 inches of deep lift asphalt base placed in 2 lifts and one inch surface, finished to the surrounding grade. The asphalt base material shall be Type B Gradation: 3/4-inch maximum, Class medium, Asphalt Concrete, and shall be compacted to a relative density of 98 percent.

All Asphalt Concrete surfaces shall be sealed with type SS-1 Asphalt Emulsion, applied at the rate as designated by the Engineer.

1301-4.2.2 Method B Backfill and Surface Restoration. - Method B backfill and surface restoration shall be used on all sewer and utility line trenches which are excavated in the general longitudinal direction of traffic in improved street sections. In unimproved areas scheduled for development Method B backfill shall be used without the surfacing requirement.

Backfill material shall be either approved native material or imported material and shall be placed in horizontal, uniform layers not exceeding 0.75 foot in thickness before compaction, except as specified for jetting below. Each layer of backfill from the bottom of the trench to 2.5 feet below finished grade shall be compacted to a relative compaction equal to the surrounding soil, but not less than 85 percent. Backfill within 2.5 feet of finished grade in existing improved areas or the basement grade in areas to be developed shall be compacted to a relative compaction of not less than 95 percent.

Compaction of backfill by jetting will be permitted only when, as determined by the Engineer, the backfill material is of such character that it will be self-draining when compacted and that foundation materials will not soften or be otherwise damaged by the applied water.

A wetting agent, approved by the Engineer, shall be added to the jetting water at a rate recommended by the manufacturer.

The length of the jetting tube shall be such that the end of the tube extends to the springline of the pipe and shall be alternately placed on both sides of the pipe during the jetting of the backfill. The backfill shall be jetted in separate layers, not to exceed 4 feet in thickness.

During jetting, the length of the jetting tube shall be adjusted so the end of the tube extends to within one foot of the bottom of the layer being saturated.

Water jetting of the backfill shall take place as soon after placing the backfill as construction will allow. No equipment capable of compacting the top layer of the unjetted backfill shall be allowed in the trench area until after the jetting operation is complete. Any area prematurely surface compacted shall be excavated to a depth of 2 feet prior to jetting.

The pavement section shall be replaced as specified herein. Immediately after completion of the backfill and compaction operation, a minimum of 12 inches of Class III aggregate base (compacted thickness) shall be placed on the compacted

backfill and surfaced with a temporary lift of 3 inches of cutback (cold mix) asphalt mixture.

The trench shall then be maintained for 30 calendar days to allow settlement to take place. The entire trench section shall then be tamped with a tamper of sufficient size to displace the trench section down to the depth of the existing pavement structure, exclusive of base rock, or a minimum of 4 inches, whichever is greater. After tamping, 4 inches or more of AC shall be placed in 2 lifts. The AC shall be Type: B, Gradation: 3/4" or 1/2" maximum, Class: medium. Where tamping is impossible because of existing facilities or other valid reasons, the temporary cold mix and sufficient aggregate base shall be removed to a depth to insure placing of 6 inches of Asphalt Concrete 4-1/2" of Type: B, Gradation: 3/4" maximum, Class: medium and 1-1/2" Type: B, Gradation: 1/2" maximum, Class: medium.

All AC surfaces shall be sealed with SS-1 Asphalt Emulsion, applied at the rate as designated by the Engineer.

1301-4.2.3 Method C Backfill and Surface Restoration. - Method C backfill and surfacing shall be used on all sewer and utility line trenches which are excavated in areas outside of existing traveled ways.

The trench shall be backfilled with either approved native or structural backfill material and compacted by jetting with water. Mechanical compaction will only be allowed with approval from the Engineer. The last 2-1/2 feet shall be compacted to not less than 90 percent relative compaction, and the surface area replaced or restored in kind. The replacement or restoration of surface improvements, such as; curbs, curbs and gutters, sidewalks, driveway aprons or other such facilities shall be comparable to or exceed the minimum city standards for such facilities.

In unimproved areas, after compaction, backfill material may be heaped 12-inches above the trench and allowed to settle naturally.

When any portion of a trench is within 4 feet of the edge of pavement or within an improved shoulder area without a curb, the surface of the trench shall be restored either in kind, or with 4-inches of Class III aggregate base, whichever is greater, and any surface improvement restored.

1301-4.2.4 Temporary Resurfacing. - Unless permanent pavement is replaced immediately, a temporary surface, consisting of Asphalt Concrete, 3 inches thick, shall be placed and maintained at locations determined by the Engineer, wherever an excavation is made through the pavement. In sidewalk or driveway areas the temporary asphalt concrete surface shall be at least one inch thick. At major intersections and other critical locations, a greater thickness of Asphalt Concrete may be required. The temporary pavement shall be constructed as soon as conditions permit, and shall remain in place and maintained until the permanent restoration of pavement is constructed.

1301-4.2.5 Mechanically Compacted Backfill. - Backfill shall be mechanically compacted by means of tamping rollers, sheepfoot rollers, pneumatic tire roller, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type approved by the Engineer. Impact-type pavement breaker (stompers) may be permitted only over reinforced concrete pipe or ductile iron pipe.

Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage

to adjacent ground, existing improvements, or improvements installed under the Contract. The Contractor shall make its own determination in this regard.

Material for mechanically compacted backfill shall be placed in lifts which, prior to compaction, shall not exceed the thickness specified below for the various types of equipment:

1) Impact, free-fall, or "stomping" equipment - maximum lift thickness of 2 feet.
2) Vibratory equipment, including vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers-maximum lift thickness of 2 feet.
3) Rolling equipment, including sheepsfoot (except for roadway base), grid, smooth wheel (nonvibratory), pneumatic-tired (nonvibratory), and segmented wheels - maximum lift thickness of one foot.
4) Hand-directed mechanical tampers - maximum lift thickness of 2 feet.

Mechanically compacted backfill shall be placed in horizontal layers of thickness, not exceeding those specified above, compatible to the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened, or dried, if necessary, and then tamped or rolled until the specified relative compaction has been attained.

1301-4.2.6 Water Densified Backfill. - Jetting shall be accomplished by the use of a jet pipe to which a hose is attached, carrying a continuous supply of water under pressure.

Unless flooding is specified or otherwise authorized by the Engineer, all backfill to be densified by water shall be jetted.

The backfill shall be jetted in accordance with the following requirements:

1) The jet pipe shall consist of a minimum of 1-1/2 inch diameter pipe to which a minimum 2 inch diameter hose is attached at the upper end. The jet pipe shall be of sufficient length to project to within 2 feet of the bottom of the lift being densified.
2) The Contractor shall jet to within 2 feet of the bottom of the lift and apply water in a manner, quantity and at a rate sufficient to thoroughly saturate the thickness of the lift being densified. The jet pipe shall not be moved until the backfill has collapsed and the water has been forced to the surface.
3) The lift of backfill shall not exceed that which can be readily densified by jetting, but in no case shall the undensified lift exceed 15 feet.
4) Where the nature of the material excavated from the trench is generally unsuitable for densification with water, the Contractor may, at no cost to the City, import suitable material for jetting or densify the excavated material by other methods. The backfill shall be allowed to thoroughly drain until the surface of the

backfill is in a firm and unyielding condition prior to commencement of any subsequent improvements. The Engineer may require the Contractor, at no cost to the City, to provide a sump and pump to remove any accumulated water.

5) The Contractor shall make its own determination that jetting will not result in damage and any resulting damage shall be repaired at no cost to the City.

1301-4.2.7 Controlled Density Fill. - Controlled density fill shall be placed in a manner as will assure complete filling of the trench without segregation of the fill and without pockets of entrapped air.

1301-5 MEASUREMENT AND PAYMENT. - The work of this section will not be separately measured for payment. Full compensation for the excavation, bedding, and backfill specified in this section shall be included in the various contract unit prices paid for pipe and structures and no additional compensation will be allowed therefor.